

## ITEM L-121 TAXIWAY LIGHTING FIXTURES AND BASES

### DESCRIPTION

**121-1.1 GENERAL.** This item shall consist of taxiway lighting systems furnished and installed in accordance with this specification, any referenced specifications, and the applicable Federal Aviation Administration Advisory Circulars. The systems shall be installed at the location and in accordance with the dimensions, layout, design, and details shown in the plans. This item shall include furnishing and installing all lights, transformers, base cans, mounting assemblies, base plates, flange rings, spacer rings, concrete work, cable connections, lamps, testing of the installation and all incidentals and appurtenances necessary to place the systems in operation as completed units to the satisfaction of the Engineer.

**121-1.2 REFERENCED MATERIALS.** Additional details pertaining to specific systems covered in this section are contained in the Federal Aviation Administration (FAA) Advisory Circulars (AC's), latest edition, listed below:

150/5340-1	Standards for Airport Markings
150/5340-26	Maintenance of Airport Visual Aid Facilities
150/5340-30	Design and Installation Details For Airport Visual Aids
150/5345-1	Approved Airport Equipment
150/5345-7	Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits
150/5345-26	FAA Specification for L-823 Plug and Receptacle, Cable Connectors
150/5345-39	FAA Specification L-853, Runway and Taxiway Centerline Retroreflective Markers
150/5345-42	Specification for Airport Light Bases, Transformer Houses, Junction Boxes and Accessories
150/5345-46	Specification for Runway and Taxiway Light Fixtures
150/5345-47	Isolation Transformers for Airport Lighting Systems
150/5345-53	Airport Lighting Equipment Certification Program

The Contractor is responsible for obtaining and using the latest edition of the referenced FAA Advisory Circulars. This is not all inclusive but is offered as a convenience to the Contractor.

### EQUIPMENT AND MATERIALS

#### 121-2.1 GENERAL.

**a.** All equipment and materials covered by referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when so requested by the Engineer.

**b.** Manufacturer's certifications shall not relieve the Contractor of the Contractor's responsibility to provide materials in accordance with these specifications and acceptable to the Engineer. Materials supplied and/or installed that do not materially comply with these specifications shall be removed, when directed by the Engineer and replaced with materials, which do comply with these specifications, at the sole cost of the Contractor.

**c.** All materials and equipment used to construct this item shall be submitted to the Engineer for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Submittals for components of

electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be boldly and clearly made with arrows or circles (highlighting is not acceptable). Contractor is solely responsible for delays in project accruing directly or indirectly from late submissions or resubmissions of submittals. The Contractor's submittals shall be in accordance with Item L-106, Submittals, Record Documents and Maintenance Manuals.

d. The data submitted shall be sufficient, in the opinion of the Engineer, to determine compliance with the plans and specifications. The Engineer reserves the right to reject any and all equipment, materials or procedures, which, in the Engineer's opinion, does not meet the system design and the standards and codes, specified herein.

e. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.

f. All items required per this section are for use on a 6.6 amp primary series circuit unless specifically noted otherwise.

**121-2.2 BASIS OF DESIGN.** The airfield lighting systems are designed using the below listed maximum fixture wattages. Approved airfield lighting fixtures with higher wattages are permissible provided the Contractor assumes all costs for the redesign of the airfield lighting and necessary power distribution systems and all costs incurred furnishing and installing any additional equipment. In no case shall the Contractor be allowed to reduce the size of the constant current regulators or the power distribution systems.

<del>L-852A</del>	<del>Taxiway Centerline Light (Category I/II - Narrow Beam)</del>	<del>65W</del>
<del>L-852B</del>	<del>Taxiway Centerline Light (Category I/II - Wide Beam)</del>	<del>65W</del>
<del>L-852C</del>	<del>Taxiway Centerline Light (Category III - Narrow Beam)</del>	<del>65W</del>
<del>L-852D</del>	<del>Taxiway Centerline Light (Category III - Narrow Beam)</del>	<del>65W</del>
<del>L-852T</del>	<del>Taxiway Edge Light (Flush)</del>	<del>45W</del>
L-861T	Taxiway Edge Light (Elevated - LED Lamp)	15W
L-861T	Taxiway Edge Light (Elevated - Incandescent Lamp)	45W

**~~121-2.3 TAXIWAY CENTERLINE LIGHTS.~~** ~~The Taxiway centerline lights shall be L-852A, L-852B, L-852C and/or L-852D as indicated in the Contract Documents. Light fixtures shall comply with environmental, photometric, dimensional and other requirements specified in the latest edition of FAA AC 150/5345-46B.~~

~~Light fixtures shall be furnished completely, assembled, unless otherwise shown on the contract drawings, with two 40-inch leads terminated in an FAA Specification L-823 two-pole plug, and one color-coded green ground wire.~~

~~Fixtures shall be class 2, base-mounted, and include a single quartz lamp. Fixture assemblies shall be bidirectional - green/green or green/traffic or unidirectional - traffic yellow/blank or green/blank, locations as indicated on the contract drawings. The casting of the fixture shall be aluminum alloy casting, low-profile construction, not exceeding 0.25 inches above grade installed as indicated on the drawings. The fixture shall be provided with a plate on the top of the fixture to protect the optics and reduce contact with~~

~~aircraft wheels. An o-ring gasket between top and bottom parts of the fixture shall provide a tight seal and the manufacturer shall provide a three-year warranty against leakage.~~

~~Fixtures and/or base plates shall be connected to the light bases by means of six threaded bolts.~~

**121-2.4 TAXIWAY EDGE LIGHTS.** Taxiway elevated edge lights shall be type L-861T equipped with incandescent or LED lamps ~~, heaters shall be included if recommended by the manufacturer for the location. Taxiway in-pavement edge lights shall be L-852T.~~ Light fixtures shall comply with environmental, photometric, dimensional and other requirements specified in the latest edition of FAA AC 150/5345-46B.

Light fixtures shall be furnished completely, assembled, unless otherwise shown on the contract drawings, with two 40-inch leads terminated in an FAA Specification L-823 two-pole plug, and one color-coded green ground wire.

Elevated edge light fixtures shall be class 2, base-mounted. Elevated edge light fixture assemblies shall be equipped with omnidirectional, blue lens. Fixtures shall be complete with 1-1/2" or 2" frangible couplings and stems to provide overall height indicated on the drawings, base plates, and clamp bands to hold the fixture globes in place.

In-pavement edge light fixtures shall be class 2, base-mounted, and include a single quartz lamp. In-pavement edge light assemblies shall be equipped with omnidirectional, blue lens. The casting of the fixture shall be aluminum alloy casting, low-profile construction, not exceeding 0.50 inches above grade installed as indicated on the drawings. An o-ring gasket between top and bottom parts of the fixture shall provide a tight seal and the manufacturer shall provide a three-year warranty against leakage.

Fixtures and/or base plates shall be connected to the light bases by means of six threaded bolts.

**121-2.5 LIGHT BASES.** All light bases (base cans) shall meet the requirements of FAA AC 150/5345-42C, latest edition. The light bases shall be L-867 type for the non-load bearing units and L-868 for the load bearing units. The sizes of the units shall be as shown in the contract drawings and in this specification. Telescoping base cans may be used for the L-867 non-load bearing base cans. Two-section light bases, may be used, where paving interferences require their use. All light bases, transformer houses and junction boxes shall be Class 1, galvanized steel. All conduit connections to lights bases shall be made with threaded couplings/hubs.

Light bases and base extensions for flush, in-pavement fixtures shall be 12" nominal outside diameter and depth as noted on the drawings. Light bases shall be FAA type L-868 to comply with FAA Advisory Circular 150/5345-42C.

Light bases and base extensions for elevated fixtures shall be 12" nominal outside diameter and depth as noted on the drawings. Base shall be provided with a ground lug to accept a no. 6 AWG ground cable and threaded hubs for conduit entrance. Light bases shall be FAA type L-867 to comply with FAA Advisory Circular 150/5345-42C.

Light bases and base extensions shall be provided with a top flange ring, spacer rings, hardware and associated equipment for a complete installation. Bolt circles of top and bottom flanges of all light bases shall be coordinated to facilitate construction.

Stainless steel bolts and two-piece lockwashers shall be provided for installation of all light bases and extensions as required. Bolts shall be of the proper length to secure the cans in place.

Base plates for elevated edge lighting fixtures shall be steel, 12" nominal diameter, and provided with a threaded conduit hub for light fixture installation. Base plates shall be provided with stainless steel bolts,

gaskets, and connector clamp for support of the lighting fixture secondary receptacle. Bolt circles of base plate shall be coordinated with top section or extension to facilitate construction.

Blank cover plates shall be sized to match the corresponding light base, junction box, etc. Cover plates shall be  $\frac{3}{4}$ " thick and provided with stainless steel bolts, gaskets, and associated hardware.

**121-2.6 REFLECTORS.** The reflectors shall be L-853 runway and taxiway retroreflective semi-flush markers as shown in the Plans. The adhesive used shall be compatible with the pavement design.

**121-2.7 CABLES.** Cables shall comply with specification L-108, Installation of Underground Cable for Airports.

**121-2.8 L-823 CONNECTORS.** Connectors shall comply with specification L-108, Installation of Underground Cable for Airports.

**121-2.9 ISOLATION TRANSFORMER.** The isolation transformers shall be L-830, 6.6 amp primary to 6.6 amp secondary, sized per the fixture manufacturer's recommendations and conforming to AC 150/5345-47A, latest edition.

**121-2.10 FRANGIBLE COUPLINGS.** All elevated items shall be installed on frangible couplings in accordance with the respective Federal Aviation Administration Advisory Circular. Frangible couplings shall be metallic and provide an electrical grounding path between the fixture and the base can.

**121-2.11 LAMPS.** Elevated edge ~~Flush, in-pavement~~ lighting fixture lamps shall be quartz of size and type to provide distribution and minimum output requirements of isocandela curves shown for each size in AC 150/5345-46B, (latest edition). All airfield lighting fixtures shall be installed with lamps.

Taxiway edge light lamps shall be ~~LED~~ lamps of size and type to provide distribution and minimum output requirements as detailed in FAA AC 150/5345-44G, latest edition. All airfield lighting fixtures shall be installed with lamps.

Lamps shall be a generic, standard design manufactured by at least two of the following manufacturers:

- a. G.E. Lighting.
- b. Sylvania.
- c. Phillips.

Proprietary lamps, that are lamps intended to be used only for one manufacturer's product(s) and that are manufactured for this sole purpose, are not acceptable. Lamps shall be readily available from local commercial electrical supply dealers for assured availability and supply to the airport.

The lamp life, as rated by the manufacturer, not the supplier, shall be warranted for the specified number of hours. Should ten percent (10%) of the lamps fail prior to the rated life of the lamp, then the entire system using the failing lamp type shall be relamped, at the Contractor's expense, and the warranty time shall start over. At the Owner's option, with written permission of the Engineer, the Contractor may elect to supply 100% spare lamps at the time of Owner's acceptance of the lighting system.

The lamp prices shall be furnished to the Owner in the bid and the prices shall be guaranteed for a period of five (5) years.

**121-2.12 COLORED FILTERS.** Colored filters, or colored lenses, to be used for Airfield Lighting Fixtures shall conform to the requirements of Military Specification SAE-AS25050 type I and FAA Advisory Circulars.

**121-2.13 TAPE.** Plastic electrical tapes shall be Scotch Electrical Tape number 88 as manufactured by

the Minnesota Mining and Manufacturing Company or an approved equivalent. Electrical coating shall be Scotchkote as manufactured by the Minnesota Mining and Manufacturing Company or approved equivalent.

**121-2.14 CONCRETE.** Concrete for backfill shall comply with Specification P-610, Structural Portland Cement Concrete and have a maximum size coarse aggregate of 1 inch and shall have a 28-day comprehensive strength of not less than 4,000 PSI and increasing with age, unless otherwise noted.

**121-2.15 CONDUIT.** Conduit shall comply with specification L-110, Installation of Airport Underground Electrical Duct.

**121-2.16 HEAT SHRINK KIT.** Heat shrinkable tubing with integral sealant for waterproofing L-823 connectors shall be Sigmaform Corporation Type APL, Raychem Corporation Type ADL, Crouse Hinds Type HSK or approved equivalent.

**121-2.17 IDENTIFICATION/NUMBER PLATES.** The identification/number plates shall be 2" diameter brass tags/monuments as shown in the plans and details. The identification shall be permanently stamped. Text height shall be 3/8".

**121-2.18 REINFORCING STEEL.** All reinforcing steel shall be ASTM A 615, Grade 60.

**121-2.19 BOLTING HARDWARE.** All airfield lighting bolting hardware shall be stainless steel and shall meet FAA requirements. All bolts 1/4" and larger shall be hex head type. All bolts smaller than 1/4" trade size shall be recessed allen type. All bolted connections shall utilize an anti-rotational locking type device. The base can cover and fixture mounting bolts shall extend through the base can mounting flange into the base can a minimum of 0.5". The bolts shall have enough thread length so they do not shoulder out before the fixture is securely tightened.

**121-2.20 ANTI-SEIZE COMPOUND.** The anti-seize compound shall be Ideal "Noalox" or approved equivalent. Use GE-RTV-118 non-curing sealant to seal between sections of base cans, spacer rings, adaptor rings or fixtures.

**121-2.21 FILLERS AND ADHESIVES.** Joint sealing filler shall comply with Specification P-605 and Joint Sealing Filler and adhesive compounds shall comply with Specification P-606, Adhesive Compounds, Two-Component, For Sealing Wire and Lights and Pavement. The P-605 and P-606 compounds shall be formulated so they are compatible with the pavement type with which they are to be used.

**121-2.22 STRAIN RELIEF CONNECTORS.** Strain relief connectors shall be Liquid Tight Thomas & Betts 2500 series with WMG-PG wire mesh cable grip or approved equivalent.

**121-2.23 DELIVERY, STORAGE AND HANDLING.** Ship materials and equipment disassembled only to the extent necessary for reasons of shipping limitations, handling facilities, and to avoid damage during shipment. Maintain materials and equipment in new condition. This shall include the use of heat lamps, suitable coverings, indoor storage, etc. to properly protect the equipment and materials. Any equipment or materials, in the opinion of the Owner or Engineer, damaged during construction or storage periods shall be replaced by and at the expense of the Contractor.

**121-2.24 SPARE PARTS.** The following table lists the electrical spare parts required to be furnished by the Contractor. All spare parts shall be identical to the same parts approved and installed in the project. The cost of all defined spare parts to be furnished to the Owner shall be included in the various unit bid items for which the spare parts are provided.

#### SPARE PARTS LIST

Category Description	Quantity	
DULUTH AIRPORT AUTHORITY	L-121-5	TAXIWAY LIGHTING FIXTURES AND BASES
DULUTH INTERNATIONAL AIRPORT		AUGUST 18, 2009
NORTH BUSINESS DEVELOPMENT AREA		REVISION 0

Fixtures:	<del>L-852A/B/C/D, Taxiway centerline light</del>	<del>10% of each configuration installed</del>
	<del>L-852T, Taxiway in-pavement edge light</del>	<del>10% of each configuration installed</del>
	L-861T taxiway edge light	10% of each configuration installed

Lamps: ~~Provide 12 spare lamps for each fixture installed of each configuration~~

## CONSTRUCTION METHODS

### 121-3.1 INSTALLATION

**a. Fixtures and Light Bases / Cans.** All fixtures, light bases / cans, etc. shall be installed as shown in the plans or approved shop drawings and in accordance with the applicable FAA Advisory Circulars and the manufacturers' recommendations. Refer to the notes on the drawings for recommended installation procedure.

Survey instruments shall be used to position all items to insure precise orientation. Orient the axis of the light beam centerline parallel to the centerline of the taxiway or taxi path respectively. Tolerances given in the FAA Advisory Circulars, these specifications, and the plans shall not be exceeded. Where no tolerance is given, no deviation is permitted. Items not installed in accordance with the FAA Advisory Circulars, these specifications and plans shall be removed and replaced by and at the expense of the Contractor.

The Contractor shall completely survey and stake out each areas lighting layout prior to starting any installation. The survey shall be performed by a professional licensed surveyor in the applicable state. Should any irregularities occur in the layout, the Engineer shall be notified immediately. The bid item price shall include the necessary surveyed layout for each item and the cost for any additional adjustment or resurvey of the location of the items due to the existing geometric conditions. The new lighting installation shall be coordinated with and blend into the existing lighting installation.

All loose material shall be removed from all excavations for electrical equipment, raceways, manholes, pads, etc. The bottom of the excavation shall be compacted to 95% compaction in accordance with ASTM D 1557 prior to the installation of the electrical item and backfill.

In new or existing pavement, all conduits, duct banks, counterpoise, light bases / cans, etc. shall be installed prior to the placement of the final lift of pavement.

Level and align each taxiway light base. Verify level and alignment of each base after each time access to light base occurs. Before paving may proceed, the Contractor shall demonstrate to the Engineer that the light bases are at the correct elevation, azimuth and rotation and that the proper clearance exists between the light base and the paving train.

The finished pavement surface shall be protected from foreign substances which could cause staining, i.e., oil, P-605, Joint Sealing Filler etc. The Contractor shall immediately clean all spills and correct/clean any stained surfaces at the Contractor's expense.

Assemble units and connect to the system in accordance with the manufacturer's recommendations and instructions. Light fixtures shall not be installed closer than or within two (2) feet of a paving joint without written permission of the Engineer.

An identification tag shall be installed with each fixture as shown in the plans. Brass circuit identification tags identifying each circuit shall be attached to each circuit as shown in the plans.

Provide six feet (6') of slack in each end of each cable in each base can. All connections shall be able to be made above ground.

All lights fixtures shall be checked and adjusted after they have been initially installed. After top section, lighting fixture, associated equipment, and pavement sealer is installed, light fixture and light beam shall be checked for correct elevation, azimuth, rotation, and level within one degree.

Install a taxiway light marker at each elevated edge light in place of one of the bolts in the base plate. The Engineer shall direct the Contractor as to which bolt to remove.

Painted and galvanized surfaces that are damaged shall be repaired according to the manufacturer's recommendations, and to the satisfaction of the Owner and Engineer. Use LPS-1G cold galvanizing compound or approved equivalent to repair galvanized surfaces. Obtain paint and primer, of same batch number, from the equipment manufacturer to repair painted surfaces.

GE RTV-118 non-curing sealant or approved equivalent shall be used to seal between sections of the light base, spacer rings, flange rings and fixtures.

All threaded portions of frangible couplings, etc. shall be coated with Ideal "Noalox" compound or approved equivalent before being assembled.

Changes to the concrete joint layout or the location of the light bases shall be submitted to the Engineer for approval. Conflicts that may occur due to changes in the joint layout or the location of the lights shall be the full responsibility of the Contractor.

If a light base is installed incorrectly, the duct/conduit is plugged/broken, the concrete joints are installed incorrectly, or the light base is sawed by the concrete saw, the concrete slabs on both sides of the light base and the light shall be removed and replaced at the Contractor's expense.

Dewatering necessary to construct L-121 Items and related erosion and turbidity control shall be in accordance with federal, state, and local requirements and is incidental to its respective pay item as a part of L-121. The cost of all excavation regardless of type of material encountered, shall be included in the unit price bid for the L-121 Item.

Deliver leveling and aligning equipment to the Airport Maintenance Department at completion of the work. At the end of the job, deliver any remaining lamps to the Airport Maintenance Department.

**121-3.2 TESTING.** This section describes the testing and demonstrations furnished by the Contractor. All items furnished and/or installed by the Contractor shall be tested and demonstrated in accordance with these specifications. All equipment and labor required for testing and demonstrations shall be furnished by the Contractor.

**a.** Fully test the installation by continuous operation for a period of not less than seventy-two (72) hours as a completed unit, prior to acceptance by the Owner.

**b.** Up to two (2) walk-throughs may be initiated by the Owner or the Engineer during which the airfield lighting units would be required to be in operation. Additional walk-throughs may be necessary depending upon the number of discrepancies found on the previous walk-throughs.

**c.** The Contractor is responsible for lamp replacements and necessary maintenance of airfield items during the testing, construction and walk-through periods.

**d.** Test cabling per specification L-108, Installation of Underground Cable for Airports.

**e.** Demonstrate all features and functions of all systems and instruct the Owner's personnel in the proper and safe operation of the systems.

f. The Contractor shall perform the necessary inspection and tests for some items concurrently with the installation because of subsequent inaccessibility of some components. The Engineer shall be notified by the Contractor forty-eight (48) hours in advance of any testing.

There are no approved "repair" procedures for items that have failed testing other than complete replacement. Any other corrective measures shall be approved in writing by the Engineer.

**121-3.3 OPERATION AND MAINTENANCE MANUALS.** The Contractor shall provide data for all equipment, material and components supplied or furnished under this section in the Operation and Maintenance Manuals. This data shall include cut sheets from the manufacturer and the manufacturer's installation, operation and maintenance manuals, recommended spare parts lists, any required test results, and other data as required by Section L-106, Submittals, Record Documents and Maintenance Manuals. The manuals shall be in accordance with Section L-106. Final payment for any contract amounts shall not be processed without proper submittal of these manuals and review and approval by the Engineer.

**121-3.4 CONTRACT DRAWINGS.** Where the electrical drawings indicate (diagrammatically or otherwise) the work intended and the functions to be performed, even though some minor details are not shown, the Contractor shall furnish all equipment, material, and labor to complete the installation work, and accomplish all the indicated functions of the electrical installation. Further, the Contractor shall be responsible for taking the necessary actions to ensure that all electrical work is coordinated and compatible with the civil plans.

**121-3.5 MINOR DEPARTURES.** Minor departures from exact dimensions shown in the electrical plans may be permitted where required to avoid conflict or unnecessary difficulty in placement of a dimensional item, provided contract requirements are met. The Contractor shall promptly obtain approval from the Owner and/or the Engineer prior to undertaking any such proposed departure.

## METHOD OF MEASUREMENT

**121-4.1 GENERAL.** The quantity of airfield lighting units to be paid for under this item shall be the number of each type installed, complete and in place, ready for operation, and accepted by the Engineer. Each airfield lighting unit shall include the installation of an identification plate or tag as detailed in the plans.

## BASIS OF PAYMENT

**121-5.1 GENERAL.** Payment will be made at the contract unit price for each item completed in accordance with the plans and specifications that is installed by the Contractor and accepted by the Engineer. This price shall be full compensation for furnishing all materials and for all preparation, assembly and installation of these materials, and for all labor, equipment, tools, incidentals, and appurtenances necessary to complete these items.

Payment will be made under:

If any of the following bid items are not included in the bid, the quantity is hereby specified as zero.

**Item L-121-5.1 INSTALL TAXIWAY ELEVATED EDGE LIGHT AND BASE (LED LAMP) -- PER EACH**

Work of this item shall include work associated with a new elevated taxiway edge light and isolation transformer in a proposed light base, but not be limited to, core-drilling, excavation, backfill, compaction, concrete work for equipment base foundation, restoration of areas, light base with hubs, hardware, PVC conduit stubs and couplings, grounding equipment, light fixture, isolation transformer, plug and receptacle connectors, connection of lighting circuit cables,



temporary lighting circuits, grounding conductor, ground rod, testing of lighting fixture separately and as a system, and all labor, equipment, tools and incidentals necessary to complete this item in accordance with these specifications and as indicated on the drawings. Payment shall be made at the contract per unit price.

**END OF ITEM L-121**